

Serial No.: 10/713,310

Examiner: D. PARRIES

Title: METHOD, MEMORY MEDIA AND APPARATUS FOR DETECTION OF GRID DISCONNECT

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**Amendments to the Claims:**

This listing of claims will replace all prior versions and listings of claims in the application.

**Listing of Claims:**

1. (currently amended) A method for preventing islanding in a power system that includes a power grid having a feeder connected in circuit with a distributed generator and at least one load, said method comprising:

determining a phase shift of a voltage based solely on multiple consecutive frequency measurements over multiple periods of time at an output of said distributed generator;

comparing said phase shift to a threshold phase shift that signifies a phase shift due to a disconnect of said grid from said feeder; and

if said phase shift is greater than said threshold phase shift, issuing a command for a disconnect of said distributed generator from said feeder.

2. (currently amended) The method of claim 1, wherein said phase shift is determined by a comparison ~~[[of]]~~ at a current zero-crossing and a previous zero-crossing of said voltage.

3. (currently amended) The method of claim 2, wherein said comparison is based on a frequency  $f_n$  at said current zero-crossing and a frequency  $f_{n-1}$  ~~[[of]]~~ at said previous zero-crossing.

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4. (previously presented) The method of claim 1, wherein said phase shift is determined by:

$$\theta_n = 2\pi \cdot \left(1 - \frac{f_{n-1}}{f_n}\right),$$

where  $\theta_n$  is said phase shift and  $f_n$  and  $f_{n-1}$  are the frequencies at a current zero-crossing and a previous zero-crossing of said voltage, respectively.

5. (previously presented) The method of claim 1, wherein said phase shift is determined by:

$$\theta_{total} = \theta_{n-2} + \theta_{n-1} + \theta_n = 2\pi \cdot \left(3 - \frac{f_{n-3}}{f_{n-2}} - \frac{f_{n-2}}{f_{n-1}} - \frac{f_{n-1}}{f_n}\right),$$

where  $\theta_{total}$  is said phase shift,  $\theta_n$ ,  $\theta_{n-1}$ , and  $\theta_{n-2}$ , are the current, the first previous and the second previous phase shifts, respectively, and  $f_n$ ,  $f_{n-1}$ ,  $f_{n-2}$ ,  $f_{n-3}$ , are the frequencies at a current, a first previous, a second previous and a third previous zero-crossing of said voltage, respectively.

6. (currently amended) A controller for preventing islanding in a power system that includes a power grid having a feeder connected in circuit with a distributed generator and at least one load, said controller comprising:

a processor, a memory and an input/output unit, wherein said memory includes a grid disconnect program that causes said processor to perform the operations of:

determining a phase shift of a voltage based solely on multiple consecutive frequency measurements over multiple periods of time at an output of said distributed generator;

comparing said phase shift to a threshold phase shift that signifies a phase shift due to a disconnect of said grid from said feeder; and

if said phase shift is greater than said threshold phase shift, issuing a command for a disconnect of said distributed generator from said feeder.

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7. (original) The controller of claim 6, wherein said phase shift is determined by a comparison of a current zero-crossing and a previous a zero-crossing of said voltage.

8. (currently amended) The controller of claim 7, wherein said comparison is based on a frequency  $f_n$  [[of]] at said current zero-crossing and a frequency  $f_{n-1}$  at said previous zero-crossing.

9. (previously presented) The controller of claim 6, wherein said phase shift is determined by:

$$\theta_n = 2\pi \cdot \left(1 - \frac{f_{n-1}}{f_n}\right),$$

where  $\theta_n$  is said phase shift and  $f_n$  and  $f_{n-1}$  are the frequencies at a current zero-crossing and a previous zero-crossing of said voltage, respectively.

10. (previously presented) The controller of claim 6, wherein said phase shift is determined by:

$$\theta_{total} = \theta_{n-2} + \theta_{n-1} + \theta_n = 2\pi \cdot \left(3 - \frac{f_{n-3}}{f_{n-2}} - \frac{f_{n-2}}{f_{n-1}} - \frac{f_{n-1}}{f_n}\right),$$

where  $\theta_{total}$  is said phase shift,  $\theta_n$ ,  $\theta_{n-1}$ , and  $\theta_{n-2}$ , are the current, the first previous and the second previous phase shifts, respectively, and  $f_n$ ,  $f_{n-1}$ ,  $f_{n-2}$ ,  $f_{n-3}$ , are the frequencies at a current, a first previous, a second previous and a third previous zero-crossing of said voltage, respectively.

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11. (currently amended) A memory media for a controller for preventing islanding in a power system that includes a power grid having a feeder connected in circuit with a distributed generator and at least one load, said controller comprising a processor, a memory and an input/output unit, said memory media comprising a grid disconnect detection program that causes said processor to perform the operations of:

determining a phase shift of a voltage based solely on multiple consecutive frequency measurements over multiple periods of time at an output of said distributed generator;

comparing said phase shift to a threshold phase shift that signifies a phase shift due to a disconnect of said grid from said feeder; and

if said phase shift is greater than said threshold phase shift, issuing a command for a disconnect of said distributed generator from said feeder.

12. (original) The memory media of claim 11, wherein said phase shift is determined by a comparison of a current zero-crossing and a previous a zero-crossing of said voltage.

13. (currently amended) he memory media of claim 12, wherein said comparison is based on a frequency  $f_n$  [[of]] at said current zero-crossing and a frequency  $f_{n-1}$  at said previous zero-crossing.

14. (previously presented) The memory media of claim 11, wherein said phase shift is determined by:

$$\theta_n = 2\pi \cdot \left(1 - \frac{f_{n-1}}{f_n}\right),$$

where  $\theta_n$  is said phase shift and  $f_n$  and  $f_{n-1}$  are the frequencies at a current zero-crossing and a previous zero-crossing of said voltage, respectively.

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15. (previously presented) The memory media of claim 11, wherein said phase shift is determined by:

$$\theta_{total} = \theta_{n-2} + \theta_{n-1} + \theta_n = 2\pi \cdot \left( 3 - \frac{f_{n-3}}{f_{n-2}} - \frac{f_{n-2}}{f_{n-1}} - \frac{f_{n-1}}{f_n} \right),$$

where  $\theta_{total}$  is said phase shift,  $\theta_n$ ,  $\theta_{n-1}$ , and  $\theta_{n-2}$ , are the current, the first previous and the second previous phase shifts, respectively, and  $f_n$ ,  $f_{n-1}$ ,  $f_{n-2}$ ,  $f_{n-3}$ , are the frequencies at a current, a first previous, a second previous and a third previous zero-crossing of said voltage, respectively.

16. (canceled)